DOCUMENT RESUME

ED 025 910 EF 002 252

By-Palmer, Fred M.

Public Address Systems. Specifications - Installation - Operation.

Pub Date Jan 66

Note-5p.; Presented at the Fifteenth Annual Meeting, Eastern Regional Group, National Association of Physical Plant Administrators, Hotel Biltmore, N.Y.C., Jan. 1966

EDRS Price MF-$0.25 HC-$0.35

Descriptors-Acoustics, *Audio Equipment, Building Design, *Building Equipment, *Campus Planning, *Communications, *Construction Programs, Facsimile Communication Systems, Microphones

Provisions for public address in new construction of campus buildings (specifications, installations, and operation of public address systems), are discussed in non-technical terms. Consideration is given to microphones, amplifiers, loudspeakers and the placement and operation of various different combinations. (FS)

ED025910

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

PUBLIC ADDRESS SYSTEMS

Specifications - Installation - Operation

By

Fred M. Palmer
Supt. Buildings & Grounds
Alfred University
Alfred, N. Y.

EF002252

Presented at
Fifteenth Annual Meeting
Eastern Regional Group
National Association of Physical Plant Administrators
of Universities and Colleges
The Hotel Biltmore, N.Y.C.
January 25-28, 1966

PUBLIC ADDRESS SYSTEMS

SPECIFICATIONS - INSTALLATION - OPERATION

Fred M. Palmer

Certainly all of you have been exposed to public address systems and some of you may have had as much experience as I have had, but we hope to bring out points today that will be of interest to all and be helpful to most of you. We will touch upon several types of public address installations but wish to dwell mostly on the provisions for public address in new construction in campus buildings. My short talk will be divided into four parts: microphones, amplifiers, loudspeakers and the placement and operation of various different combinations.

Before we proceed, there is a common misnomer used in this business that makes me boil. When a mike is called a loudspeaker it is as wrong as calling a spark plug a truck tire. A microphone is a device which converts sound waves into corresponding audio frequency electrical energy. It contains some form of flexible diaphragm which moves in accordance with sound wave variations. The movement, in turn, generates a minute voltage which is fed to the input of an amplifier where it is amplified many times. There are several types of microphone available but they all operate on the same principle.

Since we are only considering public address, let's stay with microphones best suited to this purpose. Generally, mikes are mounted on a floor stand, a lectern, a table stand, hung on the person by a cord around the neck or hand held. I have here some typical units for all these purposes which are probably familiar to you. Medium priced mikes are generally adequate for public address use if they have a frequency of 60 to 10,000 cps and are designed especially to minimize feedback (the familiar howl or squeal often heard over p.a. systems.) Also, most public address systems, especially the portable ones, have high impedance inputs; and this type mike is less expensive than low impedance units used in broadcasting and recording and elsewhere where long cables are required between mike and amplifier or control panel. It is possible to run high impedance lines as much as 100 feet without appreciable losses in the high frequencies. Farther than 100 feet or installed in conduit, low impedance lines should be used. So-called cardiod microphones are ideal for public address as they are designed to give maximum pick-up at the front and ignore sounds from the loudspeakers which is where feedback troubles start. They permit close talking and are rugged and trouble-free. There are many other models for special purposes such as high background noise rejection, long range spot pick-up, stereo effects, close talking speech clippers and telephone taps, but we will not take time for them here.

Assuming that a combination of microphones is required for a convocation, for instance, it is most important that a competent operator be at the controls at all times if a smooth and proper job is to result. He should be familiar with the program so that he will have only the proper mike or mikes turned on which are being used at the moment and be ready to reduce the gain immediately if feedback should start to develop. Preventing feedback is much easier if only one mike is on at a time because

all seem to have different resonant peaks which clash in the vicinity of loudspeakers. Also, it is bad practice to have live mikes around where they can pick up conversation or sounds that are not meant for the public.

In the classroom, laboratory or lecture room that is large enough to make voice amplification desirable, quite another condition exists. It is impractical to have an operator for every session where the p.a. is used so some compromise must be made to enable the professor to activate the built-in system with a minimum of technical know-how. He is usually willing to bring a neck microphone from his office, put it on and plug it in and that is about all that the speaker himself can be expected to do except pull the plug and return the mike to the office. I have here the Palmer professor-proof switch which I designed and built for the specific situation just described. As the mike plug is inserted into the jamb, a microswitch is activated which turns the a.c. on for the amplifier power. What is more important, when the mike plug is removed, the amplifier is automatically turned off -- a chore that the professor has trouble remembering to do. The concealed amplifier has been adjusted previously to a mike setting well below the feedback point and should need no further attention unless tampered with.

Incidentally, this professor-proof switch won second prize in the gadgets, gimmicks and witchcraft contest at the annual meeting in Raleigh which gave me quite a thrill as well as $30, in Yankee money.

We will discuss the placing of microphones a little later so this might be a good place to stop for questions that you might have relative to microphones.

A relatively new unit, designed for the border-line application where only a little speech amplification is needed, combines a lectern with a columnar loudspeaker and battery operated, transistorized amplifier to reinforce the voice enough for up to 500 people where acoustics are good, is now available as shown. Don't let anyone tell you that this unit will take the place of a public address system for large audiences out-of-doors or where there is competitive sound. This is an Ampli-Vox unit selling for about $350 complete with batteries.

Choice of an amplifier is dictated by the various acoustical requirements, the type and number of input devices to be used and the area to be covered with sound. Assume that we are planning a new dining hall, a two story building with a large lounge on the ground floor along with public rest rooms and storage, etc. The second floor has a dining room for seating 500 and an adequate kitchen and food preparation area. It is desirable to have back-ground FM radio music in all of this building all day and an adequate p.a. system for announcements at meal time and for banquets and special occasions that may force their way into this facility. We immediately realize that the only way to distribute the sound is thru numerous loudspeakers located in the acoustical ceilings. Using of rule of roughly twice the ceiling height for spacing of these speakers, we discover that a total of twenty will be required, ten in the dining room, four in the lounge, two in the serving area and four in the kitchen. In this kind of application, indoors, five watts per speaker should be ample volume for any occasion and therefore, 100 watts of amplifier power should be adequate for this entire system.

Student help is used for part of this food operation so this equipment must be behind locked doors to avoid tampering and loss. But where the manager's office on the floor above is the only safe place, so, in it goes, assembled in a rack-type cabinet with a radio tuner, record player, speaker switching panel, monitoring speaker with volume control and meter to indicate level of sound at all times. A conventional time clock switch is added to turn the unit on at 8:00 a.m. and off at 8 p.m. when the help has all left the building. Most stock amplifiers of this size have two microphone inputs, high impedance, and two radio and phono inputs. This meets our requirement except that mike inputs should be low impedance to accommodate the long runs to the dining room (three receptacles) and the first floor lounge (two receptacles). Transformers are inserted at the amplifier and low impedance mikes are to be used. Remote volume control for each room is a must with the control mounted at the wall receptacle in each case as it is difficult to be sure that the volume is correct when you are not in the room with the listeners. Also, moving the microphones around may change the feedback situation and require adjustment of the volume controls quickly, and someone should be ready to do this immediately if the old feedback bug starts to bite.

Since we are supposed to be considering amplifiers only at this time, let us get back to them. Although p.a. amplifiers have a good frequency range, they are not to be confused with so-called hi-fi amplifiers principally because of their different functions and controls. Tube type amplifiers are still most practical and inexpensive, but transistorized units are now available which have advantages of small size and cool operation. They are more expensive but may be expected to have a longer life with less maintenance with special advantages in portability and space savings where that can be a factor.

The watt is the measuring unit for amplifier and loudspeaker power capacities and amplifier units are available from 10 to 1000 watts. Seldom would more than 100 watts be found in a stock package, but all kinds of combinations of drivers and boosters are possible to create a tremendous amount of audio power.

Having extra wattage in an amplifier is like having a car powered to go 120 miles an hour although you never intend to exceed 70. It should deliver all the volume you require without any distortion which is of primary importance. A 100 watt amplifier would cost about 20% more than a 50 watt unit, so specify oversize. The power consumption and upkeep are not appreciably higher. Stock amplifiers with only two microphone inputs can be adapted for any number with transistorized mixer boxes so that having more than two mike inputs is not really necessary.

We must discuss loudspeakers and the importance of their placement and phasing. Dozens of manufacturers make hundreds of models of speakers but only a few of these are designed for public address purposes. For voice amplification out of doors, the old trumpet type horn is hard to beat. The low range is limited and music is not well reproduced, so other types of weather-proof speakers are available for this broader application. It is desirable to have the speakers located in one place so that sound will appear to come from where the person is seen speaking. Usually this is not quite possible, so speakers should mount at each side of the speaker's

platform and cover the entire area from there. In an open outdoor area avoid pointing speakers toward any hard vertical surface that will bounce sound back toward the audience causing reverberation. In a football game set-up, for instance, a small installation to seat 10,000 persons would require a 100 watt amplifier and four 25 watt trumpets located at the scoreboard or press box. Ten watts per 1000 people can be a useful figure in deciding power requirements for amplifiers and speakers for football stadia.

Phasing of loudspeakers is extremely important and simply means that they will be so wired that all diaphragms move together as one and in conjunction with the natural sound itself. Electrical energy flowing thru the voice coil winding of a loudspeaker driver causes the coil to travel in the gap of a powerful magnet. The direction of the flow of current decides the direction of the movement, so, if the diaphragms are not moving together, reversing the leads of one speaker will correct the movement. The speaker diaphragm is the medium by which the electrical energy from the amplifier can vibrate the air in front of it with sound waves corresponding in frequency with those put into the diaphragm of the microphone and with much greater force and amplitude. When all diaphragms are traveling together they move the whole air mass in front of the loudspeakers as one. Any diaphragms that are out-of-phase tend to cancel sound waves where they overlap and, not only reduce total power but confuse listening people.

We have tried to keep this discussion as free from technical terms as possible in the hope that all of you could grasp the whole picture easily. This is a very complicated and interesting field and volumes of data and hours of discussion would be necessary to cover it adequately, so with this lament, we must close.